which Fancini was the inventor in 1672, are generally 3 feet long: they are made with edges which unite with precision, and are cemented with mortar and pieces of leather, and fastened with strong iron screws. If the diameter be 4 inches the thickness should be 4 lines, and as the diameter increases 2 inches the thickness should increase 1 line: thus a tube 10 inches in diameter should be 7 lines thick. The iron should be well fused without boiling, and of equal thickness. In the country aqueducts leaden pipes should not be employed too lavishly, as they are liable to be stolen. But when pipes of wood, stone, or iron require elbows, these must be made of lead, and united to the others by means of edges and pieces of leather.

In Vienna glass pipes have been tried, as being cheaper, and as offering less obstruction to the flow of the water; but whether successful or not I am unable to say. Whatever may be the kind of aqueduct, there should be at various distances man-holes, little wells, or chambers, by which the defects in the pipes may be seen: at the bottom of these man-holes a deep well should be made, to receive the water whenever a part of the aqueduct is required to be made dry: whether the tubes lie on a declivity or acclivity, these wells should always be lower. At various distances air pipes are necessary: these are small upright pipes introduced into the main pipe, and supported by a tree, a post, or a wall, and raised some feet above the level of the water. These air-holes are for purposes of ventilation, without which the air, being pent up in the pipes, would impede the flow of the water, and in consequence would burst them. These pipes, or ventilators, should be always left open, with the exception of some slight covering, to prevent any dirt or rubbish falling in. Instead of these ventilators, vertical tubes of from 4 to 5 inches high may be soldered in the man-holes and closed by a valve loaded with lead of an equal weight with the column of water: by this means the valve only opens by the pressure of the air within.

The pipes are continually subject to obstructions, from the growth of vegetable matter and the deposits of lime and sand, which form a crust on the sides of the pipes, and thus prevent the easy exit of the water. Petrifactions occur most frequently in the bends of the pipes, as the water, flowing with less rapidity along these bends, has more time to make its depositions.

To compensate in some measure for these obstructions the elbows should be as little bent as possible, and the diameter of the pipes should be increased.

To prevent the accumulation of foreign matter attach a rope to a broom or brush proportioned to the size of the tube, leaving it to float along the water, observing if it make its exit at the first man-hole where the other end of the cord must be drawn, and then some proper instrument can be attached for the removal of all obstacles. But if the petrifactions be so great as to stop the progress of the broom, this may be easily remedied, as the exact site of the impediment is indicated by the length of the cord. When the pipe encounters an eminence higher than the source of the water, a trench must be dug sufficiently deep to build an arched conduit, and within which the pipes must be laid according to the inclination of the water. In this arch man-holes must be made, that any defects arising may be easily observed. The pipes which pass under the principal streets should be covered by these arched conduits, to prevent breakage from the jolting of the carriages, which we know even the best iron pipes cannot resist. Water may be conducted to its destination by a subterraneous passage without using pipes, where the earth will permit. In this case a canal must be made, well cemented at the bottom, and flanked by two small banks, to facilitate the cleansing and repairing. These were and are the aqueducts of Rome. The aqueducts, if of stone, should be lined with bituminous earth (*torba*), which will cut, when moist, into little squares 1 foot long and 5 inches thick. Two courses of these squares, still moist, must be used, the joints of the upper covering those of the lower: powdered sand must be used with it, which is to make the *torba* bind better. These aqueducts will endure for ages, and are impervious to frost. When the water can be conducted in streams, and through deep valleys, it is customary always to sustain the water by an aqueduct of brick raised upon arches, as has been already said: if possible, these constructions, so expensive and so exposed to injury, should be avoided, and it is possible to lead the water through the valleys by means of conduits or pipes, and it may be forced over the eminences it encounters.

This entirely depends on the property that water possesses of always finding its own level, and of rising to the same height as the communicating pipes. This property is the basis of all the theories on the management of water. This general law of nature, so well known and so easy to understand at the present time, appears to have been unknown to the ancients; for had it been otherwise they would have certainly made use of *ascending* and *descending* tubes or conduits to conduct water any great distance, as it would have saved the expense of arched aqueducts, instead of which they only employed descending subterranean canals to conduct the water from an elevated place to a lower: at any rate there is nothing left to prove to us that ascending canals were ever used by them. If the aqueduct be too large it can be divided into several branches which may be reunited after the height has been surmounted. It is true that water only rises to the same height as it descends, and that the bends are a great impediment to the velocity of the water: this inconvenience may be compensated by avoiding the construction of arches, and the work can be easily united when the height to which it is raised is less than that to which it descends. It is difficult to determine the exact slope which should be given to rivers or aqueducts, according to the quantity of water which runs through them. Vitruvius gives six inches slope to every 100 feet of length. Experience shows that this is too much, and that two feet slope is sufficient for 1,000 perches when the bends in the river are only so slight as to offer no sensible opposition to the velocity of the water. The general rule is to give two inches slope to every 600 feet, when the foundation through which the water passes is not rough. It would be no objection to make the slope more rapid, which would increase the velocity of the water. This is very well if there is no other end in view, but if the water has to be conducted to a limited height, or if the possibility or impossibility of a plan depends on the slope which can be given to a river or canal,—as, for example, if water has to be carried far to a city to form a foundation, it would be necessary that the castellum where the water is collected should be as elevated as possible, in order that it may arrive at the cisterns of supply in the highest quarters. If the object be to conduct the water to a reservoir to make a jet in a garden, the height of the jet depending on the height of the reservoir, it would not be possible to increase the slope of the pipes without lowering the reservoir; consequently in such a case the slope must be confined to certain limits. It is much easier to conduct water on a level than on a slope. Thus, for example, when a canal is to be made with 2 inches of slope to 600 feet, the first 300 feet can be made on a level, and then a fall of an inch, and then another 300 feet and a fall of another inch. Thus the aqueduct will decline gradually. We must not confound the water which runs from the river into the aqueduct with that which is closed in the tubes, because the velocity of the latter being retarded by friction, it is necessary to have regard to the slopes and counterslopes from the source of the water to its destination, in proportion to its weight or quantity. Thus theory has no fixed rule, but we must be guided by practice.

As a general rule, the larger the tubes the greater the supply of water, because the friction of water is greater in proportion as the tubes are narrower. When the conduit carrying the water from one cistern to another is not longer than 600 feet, the custom is to load it to the amount of 18 inches to make it rise 20 feet; 24 inches to make it rise from 20 to 30 feet; and increasing it for every 10 feet of elevation, which may go on to that of 60 feet; but beyond this point, the number of inches may be reduced to 4 for every 10 feet. With respect to the distance between the two termini, when it is beyond 600 feet, 3 inches of height must be added to the elevation of every 600 feet."

The above extract from a favourite author, I have presumed might be considered interesting to those readers of your extensively circulated journal who might be unable to translate it from the Italian. It will give me much pleasure if it induce further observations upon so important a matter: the steam-engine gives now powerful aid to carry out more gigantic projects, as by its aid water may be raised from a lower to a higher level.

EDWARD CRESY.

NOTES IN THE PROVINCES.

AN extensive breach (nearly 200 feet) was lately made in the esplanade wall at Weymouth. The council applied for tenders, and that of Mr. D. Stone was accepted. The difference between the highest and the lowest tender was upwards of 200*l*. The repairs are to be commenced forthwith.——A fire broke out in Silverstone church, on Sunday week, during service. The stove-pipe, passing through the roof, was, as usual, the means of firing the timber, which, in this case was that supporting the lead casing. The damage was inconsiderable, assistance being promptly got.——At a recent vestry meeting in St. Peter's, Bedford, as to proposed alterations in the church, Mr. T. Small made some remarks upon the manner in which the contracts had been disposed of, and stated that complaint had been made that sufficient care had not been taken to secure the contract being faithfully carried out. Amongst other things, it was not binding to take the lowest tender. The rector said that so soon as the contributions were sufficiently large, and a plan of extending the building was drawn up and approved of, notices were issued for tenders, and the following were sent in:—Masters, 684*l*.; Joy, 668*l*. 15*s*.; Miller, 665*l*.; French, 620*l*. The churchwardens unanimously agreed, provided good security were given, to accept the lowest tender; although he was convinced the alterations could be made for 600*l*., and to which sum he induced French to alter his contract.——At Newmarket, the old weighing-house, in the Beacon course, has been taken down, and the rails removed as far as the Duke's stand. The course is thus set back at the end of it for about 17 yards. A new weighing-house and jockeys' retiring-room are in course of erection at about 16 yards from the new boundary line of the course, so as to leave an enclosed area in front of the new stand. In the Round course, the rotten old wooden structure has disappeared, and a new weighing-house has been erected about 6 yards past the winning-post.——A local paper proposes that the Reading market-house lately projected be made of glass chiefly, for cheapness. It complains that a town such as Reading should be without protection from the weather to its best customers, while the minor towns of Abingdon, Wantage, Wallingford, Henley, and Basingstoke, all can point to their superiority in this respect.——A case has arrived from France containing a bronze cast about 8 feet in height, and intended for the monument of the Duke of Rutland to be erected at Leicester.——The Oxford Gas Company have resolved to reduce the price of gas further to 6*s*. 8*d*. per thousand feet; but, considering the price elsewhere, the *Oxford Chronicle* thinks this will not be deemed a sufficient reduction.——The Lutterworthians, after meditating for fifteen years on a project then started for the lighting of their town with gas, are at last "rejoicing in the light," having just had their streets "brilliantly illuminated." Their gas-work was planned by Mr. Thomas Sharp, of Northampton, and erected by Messrs. R. and J. Law, of Lutterworth. The fixed apparatus, mains, and services were supplied

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